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Indian Standard

SPECIFICATION FOR MEDICAL TREATMENT LAMPS

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 6 *November* 1983

Indian Standard

SPECIFICATION FOR MEDICAL TREATMENT LAMPS

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SPECIFICATION FOR MEDICAL TREATMENT LAMPS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 25 February 1983, after the draft finalized by the Electromedical Equipment Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard has been formulated with a view to ensure the mechanical and electrical safety for medical treatment lamps for use in hospitals and homes.

0.3 In the preparation of this standard considerable assistance has been derived from BS 3232 : 1968 'Specification for safety requirements for medical treatment lamps' issued by the British Standards Institution.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard specifies safety requirements for medical treatment lamps intended for operation on a supply voltage of 220 V dc or 240 V ac which incorporate an ultra-violet, radiant heat or infra-red emitter or a combination of two or more of these.

1.2 It does not apply to ultra-violet, radiant-heat or infra-red baths or tunnels of the bed-cradle type.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions given in IS : 1885 (Part 43)-1977† shall apply in addition to the following.

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*Rules for rounding off numerical values (*revised*).

†Electrotechnical vocabulary: Part 43 Electrical equipment used in medical practice.

2.1.1 *Medical Treatment Lamp* — An apparatus for the purpose of treatment having one or more of the sources of radiation given in **2.1.2**, **2.1.3** and **2.1.4**.

2.1.2 *Ultra-Violet Emitter* — An emitter designed for medical treatment by radiation at wavelengths of approximately 400 nm and below.

2.1.3 *Radiant-Heat Emitter* — An emitter designed for medical treatment by radiation at wavelengths of approximately 400 nm and above.

2.1.4 *Infra-Red Emitter* — An emitter designed for medical treatment by radiation at wavelengths of approximately 800 nm and above.

2.1.5 *Multi-purpose Lamp* — A lamp with a housing incorporating more than one type of emitter.

2.1.6 *Rated Voltage* — The voltage assigned to the lamp by the manufacturer.

2.1.7 *Rated Loading* — The input at normal operating temperature assigned to the lamp by the manufacturer.

2.1.8 *Portable Lamp* — A lamp held in the hand during normal use and can easily be carried by hand.

2.1.9 *Transportable Lamp* — A lamp not intended to be portable but which can readily be moved from one place to another.

2.1.10 *Stationary Lamp* — A lamp intended to be fixed to its supporting surface or used in one place.

2.1.11 *Class I Lamp* — A lamp having some basic insulated parts which can be touched and are required to be earthed.

2.1.12 *Class II A (Insulation Encased) Lamp* — A lamp in which a durable and substantially continuous enclosure of insulating material envelopes all metal parts, excepting small parts, such as nameplates, screws, or rivets which are isolated from other metal parts by insulation at least equivalent to reinforced insulation.

2.1.13 *Class II B (Double-Insulated) Lamp* — A lamp in which double insulation is used throughout, excepting for parts where, because double insulation is manifestly impracticable, reinforced insulation is used.

2.1.14 *Basic Insulation* — The insulation necessary for the proper functioning of the lamp and for basic protection against electric shock.

2.1.15 *Basically Insulated Parts* — Metal parts that are separated from live parts by basic insulation only.

2.1.16 *Protective Insulation* — An independent insulation provided externally to the basic insulation and the basically insulated parts, in order to ensure protection against electric shock in case of failure of the basic insulation.

2.1.17 *Type Tests* — Test carried out to prove conformity with the requirements of this standard. These are intended to prove the general qualities and design of a given type of equipment.

2.1.18 *Routine Tests* — Tests carried out on each item to test the essential requirements which are likely to vary during production.

3. CONSTRUCTION AND GENERAL REQUIREMENTS

3.1 General — Materials used shall be resistant to corrosion or have a finish which protects against corrosion at temperatures and environments to which they are normally subjected. Any finish shall continue to withstand the conditions of normal use without undue deterioration.

3.1.1 The lamps shall be designed to operate at a rated voltage of 220 V ± 6 percent dc or 240 V ± 6 percent ac.

3.2 Mounting and Adjustment — Where the weight of a lamp housing exceeds 3·2 kg it shall be counterbalanced. Where the lamp housing is capable of adjustment, limit steps shall be provided where necessary to prevent possible hazardous conditions during normal operation. Any locking mechanisms shall be easily operated. A portable lamp shall be provided with a handle or other means for lifting.

3.2.1 The heavy assembly of ultra-violet lamps of higher capacity with separate starter transformer and other accessories shall be mounted in such a way that it provided good stability and ease of operation.

3.3 Connection to Supply

3.3.1 Lamps which are not intended to be permanently connected to fixed wiring shall be provided either with a non-detachable flexible cord or an appliance inlet. If an appliance inlet is used it shall be so placed that the connector can be inserted without difficulty and it shall comply with IS : 3010 (Part I)-1965* and have a current rating not less than the current rating of the lamp.

3.3.2 Lamps intended for permanent installation shall be provided with proper entry facilities arranged conveniently for mains supply terminals, for example, a suitable bushed entry for a flexible cord or a tapped hole for screwed conduit.

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*Specification for appliance-connectors and appliance-inlets (non-reversible three-pin type): Part I Appliance connectors.

3.4 Terminals

3.4.1 The materials, design and proportions of all terminals shall be such that connections made shall not slaken or overheat under the normal conditions of use. Terminals shall be such that they accept all strands of the conductors connected and these are rigidly and effectively clamped between metal surfaces. Terminals and conductors used in the lamps shall be of such sizes as to handle the current rating of the equipment without any perceptible rise of temperature of the cable and terminal and any damage to the lamp.

3.4.2 In pinch screw type terminals the screw shall be of sufficient length to extend to the far side of the terminal hole and shall be of a diameter approximately equal to that of the hole. The ends of the screws shall be rounded or chamfered to prevent undue damage to the conductors; the side of the hole against which the screw bears shall be smooth and continuous.

3.4.3 A self-tapping screw shall not be used for any form of terminal.

3.4.4 All connections shall be made in such a way that the wires of the conductor are prevented from slipping or spreading at the terminal.

3.4.5 Terminals shall not be used for any purpose other than forming an electrical connection.

3.4.6 A lamp which is provided with a non-detachable flexible cord shall have two supply terminals, and where applicable an earth terminal and these shall be located so that:

a) extensive dismantling is not necessary to gain access;

b) the flexible cord can be replaced without disturbing internal wiring or other live parts;

c) they will not work loose when conductor clamping screws are tightened or loosened;

d) there shall be at least two full threads of engagement on terminal screws and nuts when the largest size of conductor is clamped; and

e) the supply terminals of lamps with single pole switches shall be marked:

Line terminal — 'Line' or 'L'
Neutral terminal — 'Neutral' or 'N'

In other lamps the supply terminals shall be readily distinguishable from other terminals and screws. The earthing terminal, on Class I lamps, shall be marked with the symbol ⏚ or coloured green. Where space permits the additional symbol 'E' shall be marked.

Such markings shall not be placed or screws, washers or other parts which might be removed when conductors are being connected or disconnected.

Where a lamp has only one emitter which is connected to the supply by means of a lampholder and there are no auxiliary connections on the appliance, separate supply terminals need not be provided.

3.5 Supply Connection or External Cords

3.5.1 Lamps shall not be provided with more than one supply cord. Plugs shall not be fitted with more than one flexible cord.

Compliance shall be checked by inspection.

3.5.2 Flexible cords shall comply with the requirement of Table 2 or Table 4 of IS : 694-1977*, excepting single core cords.

NOTE — Because of the possibility of ultra-violet radiation having detrimental effect on rubber-sheathed cords it is recommended that PVC or polychloroprene, sheathed cords be used with lamps which incorporate ultra-violet emitter.

3.5.3 Polyvinyl chloride sheathed and/or PVC insulated flexible cables and cords shall not be used for lamps incorporating hot parts with an operating temperature rise exceeding 75°C (or 85°C for heat-resisting PVC) which might be touched in normal use by the cable or cord.

NOTE — In considering normal use, the likelihood of winding the flexible cord round the hot appliance for storage has been taken into account.

3.5.4 For a Class I lamp with a flexible cord the cores shall be connected as follows:

Green-and-yellow	Earth
Red	Line
Black	Neutral

3.5.5 If the lamp is provided with an appliance connector the connector shall comply with IS : 3010 (Part 1)-1965† and the current rating of the flexible cord shall be not less than the value corresponding to the current rating of the connector. In other cases the cross-sectional area of supply conductor of a flexible cord shall be such that the lamp can be operated at the specified current rating without any perceptible rise of temperature of the flexible cords and any damage to the lamp.

3.5.6 Portable and transportable lamps or their appliance inlet connectors shall be provided with not less than 1·8 m of flexible cord measured from the cord grip.

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*Specification for PVC insulated cables for workings voltage up to and including 1 100 V (*second revision*).

†Specification for appliance-connectors and appliance-inlets (non-reversible three-pin type) : Part 1 Appliance connectors.

3.6 Flexible Cord Anchorage

3.6.1 When non-detachable flexible cord is used it shall be anchored so that the ends of the cord connected to the terminals are relieved from strain. A knot in the cord or similar method shall not be used. When secured it shall not be possible to push the flexible cord further into the apparatus.

3.6.2 The arrangement of the cord inlet of an appliance which is normally moved while working shall be such that the cord is protected against excessive bending at the inlet opening. If a cord guard is used for this purpose, it shall be of insulating material and be securely fixed to the appliance (*see* **6.9**).

3.7 Internal Connections — All electrical connections including earth connections shall be made so as to ensure the maintenance of good and reliable contact. Lead-out wires which are part of, or are permanently connected to an emitter shall be connected to terminals other than those to which the flexible cord is permanently connected.

3.8 Switches — An on-off switch shall be fitted. Where a single pole switch is fitted it shall be in the line. Where fitted, a switch shall be so located that it is not exposed to mechanical damage and it shall have a clear and indelible indication of its function.

3.9 Insulation — All electrical insulation shall satisfy the requirements of **6.10** and **6.11**. Creepage distances and clearances shall be not less than the values given in Table 1.

TABLE 1 CREEPAGE DISTANCES AND CLEARANCES

	CLASS I LAMPS	CLASS II LAMPS
1. *Creepage Distances* :		
a) Between live parts of different polarity :		
i) if protected against deposition of dirt	2	2
ii) if not protected against deposition of dirt	3	3
b) Between live parts and other metal parts:		
i) over basic insulation protected against dirt:		
if of ceramic material, pure mica and the like	2·5*	5
if of other material	3	3
ii) over basic insulation not protected against dirt	3	3
c) Between live parts and other metal parts separated by reinforced insulation	—	8
d) Between metal parts separated by protective insulation	—	4

*These values are reduced to 1 mm for the distance between supply terminals and metal sheaths of tubular sheathed infra-red and radiant-heat elements.

(*Continued*)

TABLE 1 CREEPAGE DISTANCES AND CLEARANCES — *Contd*

	CLASS I LAMPS	CLASS II LAMPS
e) Between live parts and metal foil on the outer surface of enclosures of insulating material	—	5
2. *Clearances* :		
a) Between live parts of different polarity:		
i) if protected against deposition of dirt	2*	2
ii) if not protected against deposition of dirt	3	3
b) Between live parts and other metal parts, separated by basic insulation only, or between bare live parts and the inner surface of protective insulation:		
i) if protected against deposition of dirt	2	2
ii) if not protected against deposition of dirt	3	3
c) Between live parts and other metal parts, separated by reinforced insulation	—	8
d) Between metal parts separated by protective insulation	—	4
e) Between live parts and metal foil on the outer surface of enclosures of insulating material	—	5
3. *Distances Through Insulation*† :		
a) Between metal parts separated by protective insulation	—	1
d) Between metal parts separated by reinforced insulation	—	2
c) Between live parts and the test finger when this is applied to any point on an enclosure of insulating material	—	2

NOTE 1 — The contribution to the creepage distance across any groove of less than 1 mm width is limited to its width.

NOTE 2 — Any air gap of less than 1 mm width is ignored in computing the total air path.

NOTE 3 — The clearance required between live parts of different polarity do not apply to the air gap between the contacts of micro-gap switches and the like.

*These values are reduced to 1 mm for the distances between supply terminals and metal sheaths of tubular sheathed infra-red and radiant-heat elements.

†These items may consist of a thickness of insulation plus one or more air gaps. This may be reduced if two or more separate layers of insulation are used each capable of withstanding the tests of **6.11**.

3.10 Earthing (Class I Lamps Only) — Except for small parts, such as screws or nameplates isolated by insulating material, all metal parts of the lamp that can be touched with test finger as specified in **8** of IS : 302-1973*, when tested in accordance with **6.12** shall be effectively bonded together and connected to the earth terminal. The resistance of the earth bonding shall comply with the requirements of **6.12.**

3.11 Protection

3.11.1 All exposed emitters which, when operating in an ambient temperature not exceeding 40°C have a surface temperature greater than 65°C shall be recessed into the lamp.

Compliance shall be checked by the method described in **6.6.**

3.11.2 Lamps incorporating an emitters which have exposed live metal parts shall be fitted with a guard of rigid construction and securely fixed. The spacing between parts of the guard forming openings shall not exceed 38 mm.

The effectiveness of any guard in preventing contact with live parts shall be checked with the test described in **6.3.**

3.11.3 All lamps fitted with guards shall comply with the requirements of the flammability test described in **6.8.**

3.12 Maximum Operating Temperature-Rise — The maximum operating temperature rise of the component parts of the lamp when measured as described in **6.5** shall not exceed the limits given in Table 2.

3.13 Protection Against Electric Shock — The complete lamp shall not have any openings giving access to live parts, or in the case of Class IIB lamps, basically insulated parts or basic insulation, other than openings necessary for the use and working of the lamp. Where such openings are necessary sufficient protection against accidental contact with live parts, basically insulated parts or basic insulation, shall be provided as necessary to comply with **6.3.**

3.14 Stability — Lamps shall have adequate stability and comply with the requirements of **6.2.**

4. ACCOMPANYING DOCUMENTS

4.1 The manufacturer shall supply with each lamp printed instructions for its safe and proper use. These shall include a reference to the importance of obtaining medical advice concerning its method of use for treatment.

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*General and safety requirements for house-hold and similar electrical appliances (*fifth revision*).

TABLE 2 MAXIMUM OPERATING TEMPERATURE-RISE

(*Clause* 3.12)

SL No.	COMPONENT PARTS	TEMPERATURE-RISE °C
1.	Surface of handles which may be gripped:	
	Metal	15
	Porcelain or vitreous material	25
	Moulded material, rubber, wood, and other non-metallic materials	35
2.	Surface of handles which are normally held for a short period, for example, switch handles:	
	Metal	20
	Porcelain or vitreous material	30
	Moulded material, rubber, wood, and other non-metallic materials	45
3.	Rubber insulation at places where breakdown of this insulation might cause a short circuit between live parts or between live parts and non-current-carrying metal parts	35
4.	Other insulating materials:	
	Phenolic mouldings, cellulose filled	70
	Phenolic mouldings, mineral filled	85
	Urea formaldehyde	50
	Thermo-plastic (polyacrylates, polyethylene, polystryrene and normal grades of PVC)	*
5.	Exposed parts of reflector and lamp housing	45

*The temperature-rise is yet to be determined as there is no specific limit for thermoplastic material which must withstand the test.

4.1.1 Advice shall be included for the protection of the eyes against exposure to ultra-violet or infra-red radiation, since inflammation of the eyes can result from over exposure.

4.1.2 The manufacturer shall declare the spectral energy characteristics of the lamps.

5. MARKING

5.1 Every medical treatment lamp shall be marked with the following:

a) The name of the manufacturer;

b) The rated voltage or voltage range;

c) Nature of supply, if to be observed (for example, 50 Hz ac only); and

d) Maximum loading in watts.

5.2 Class II lamps shall be marked double insulated or insulation encased as appropriate or with the symbol ⧈ .

5.3 For all class I lamps the following information shall be given on a label attached to the end of the flexible cord, if supplied with the lamp, otherwise the label shall be attached to or near the input terminals. For Class I lamps other than those intended to be permanently connected to fixed wiring the information shall also be included in the user instructions.

'WARNING — THIS APPLIANCE SHALL BE EARTHED'

Compliance shall be checked by inspection.

5.3.1 For all Class I lamps supplied with a flexible cable or cord having cores coloured green-and-yellow, red and black the user instructions and a label shall state the following:

'IMPORTANT'

The wires in this mains lead are coloured in accordance with the following code:

Green and yellow	Earth
Black	Neutral
Red	Line

5.4 If an access over is likely to be removed by the user in order to make simple adjustments and if thereby live parts are rendered accessible a permanent notice shall be fixed to the cover stating the following:

'REMOVE PLUG OR DISCONNECT FROM THE MAINS BEFORE REMOVING THIS COVER'

5.5 If a heat-resisting cord is fitted to a lamp, the instructions must include a note:

'This lamp must be fitted with a heat-resisting cord, if the cord is replaced'.

5.6 Detachable emitters shall be marked with:

a) Rated voltage or voltage range, and

b) Rated loading in watts.

5.7 The lamp may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors may be obtained from the Indian Standards Institution.

6. TESTS

6.1 Classifications of Tests

6.1.1 *Type Tests* — Following shall comprise the type tests:

a) Test for stability (**6.2**),
b) Protection against electric shock (**6.3**),
c) Input test (**6.4**),
d) Temperature-rise test (**6.5**),
e) Test for recession of emitters (**6.6**),
f) Test for mechanical strength (**6.7**),
g) Test for flammability (**6.8**),
h) Test for cord anchorage (**6.9**),
j) Insulation resistance and electric strength tests (**6.10**),
k) Test for electrical insulation and leakage current at operating temperature (**6.11**),
m) Earth continuity test (**6.12**),
n) Test for spectral characteristics (**6.13**),
p) Test for uniformity of heating (**6.14**), and
q) Life test (**6.15**) (*under consideration*)

6.1.2 *Routine Test* — The following shall constitute routine test and shall be conducted on each item.

a) Insulation resistance (**6.10.1**).

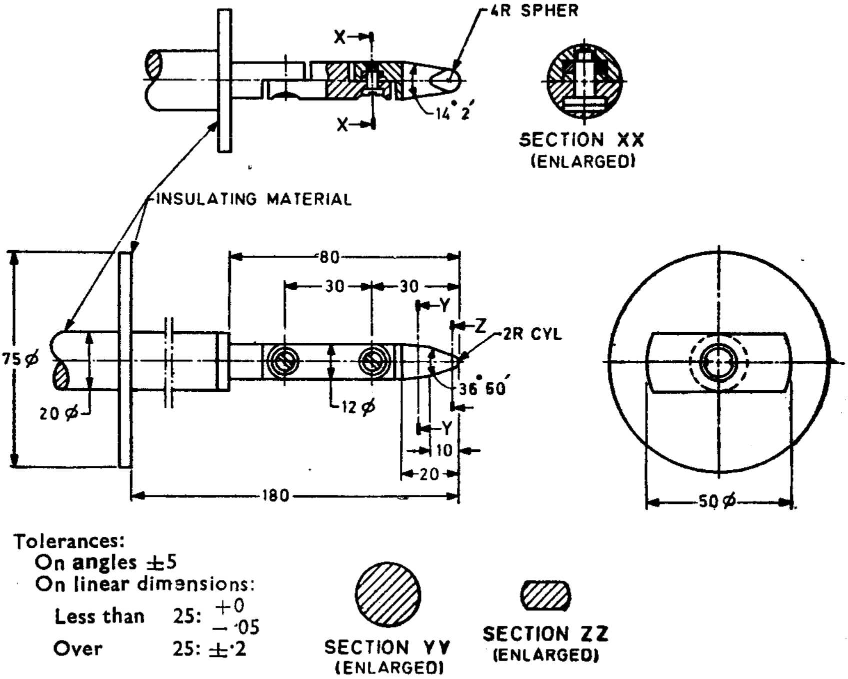
6.2 Test for Stability — When placed in its most unfavourable position on a plane inclined at an angle of 10° to the horizontal the lamp shall not overturn. All lamps fitted with castors shall have their castors locked in their innermost position when carrying out this test.

6.3 Protection Against Electric Shock — The test is carried out on the complete lamp, which shall include the flexible cord where this is detachable, by inspection and by means of test finger shown in Fig. 1. For class I appliance it shall not be possible to touch live parts with the standard test fingers. In addition for class II appliances, it shall not be possible to touch basic insulated parts with the test finger or live parts with the test pin shown in Fig. 2 when these are inserted without force.

For portable and transportable appliances the test finger and in addition the test pin in the case of class II appliances only, shall be inserted in every possible position, without force. For stationary appliances the test shall be carried out with the lamp in the installed position.

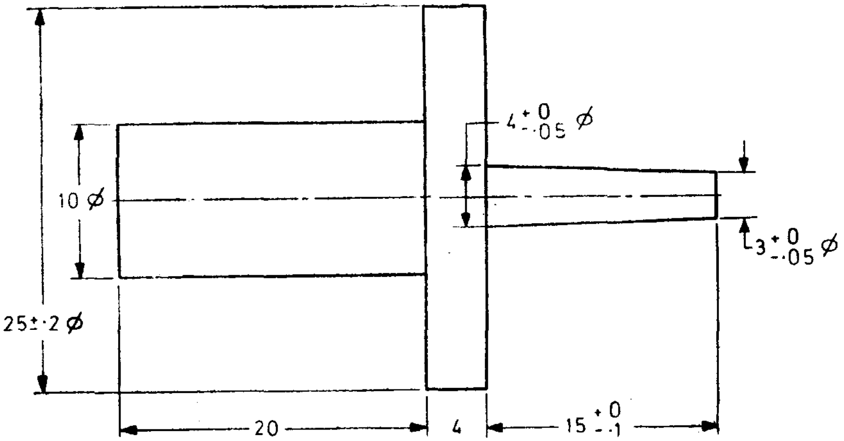
The above test shall be made after the removal of all parts except emitter which can be removed without the use of tools. When testing accessibility of live parts of lamp caps and Edision screw lampholders, the connections with the lampholders shall be reversed.

NOTE — Reversal of these connections is for the purpose of this test only.



Tolerances:
On angles ±5
On linear dimensions:
Less than 25: $^{+0}_{-\cdot 05}$
Over 25: ±·2

FIG. 1 STANDARD TEST FINGER



All dimensions in millimetres.

FIG. 2 TEST PIN

6.4 Input Test — The lamp shall be mounted in its normal position of use and operated at its rated voltage, or the mean of a voltage range, for 30 minutes. The input watts at the end of this period shall not deviate from the rated loading by more than ± 10 percent.

6.5 Temperature-Rise Test — The lamp shall be operated in an ambient temperature not exceeding 40°C (*see also* **11.8** of IS : 302-1973*) for 1 hour at its rated voltage or where a voltage range is marked at the higher of the voltages. At the end of this time the temperature-rise of each part of the lamp listed in Table 2 shall be measured and shall not exceed the value indicated.

6.6 Test for Recession of Emitters — The recession of emitters shall be checked using the emitter recession test templet shown in Fig. 3A.

6.6.1 The apex *A*, of the templet shall be inserted into all openings of the lamp from which infra-red, radiant-heat or ultra-violet energy is intended to be radiated when the lamp is in operation. Following insertion the templet edges *AB* and *AC* shall be placed in contact with the opposite edges of the opening such that the two points of contact, *x* and *y* respectively, on *AB* and *AC* are equidistant from the templet apex *A*.

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

In addition, in the case of:

a) openings having a circular cross section, the plane of the templet and any diameter of the opening shall be coincident;

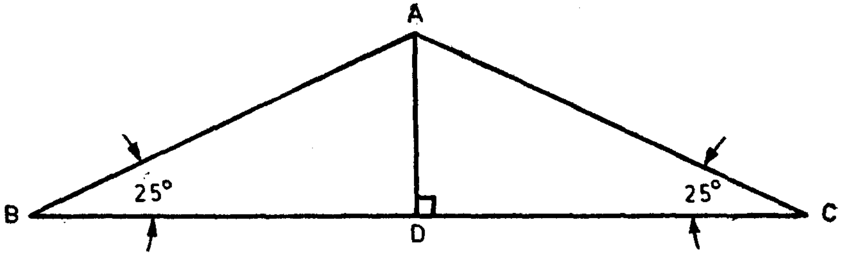
b) openings having parallel edges, for example, a parabolic trough reflector, the plane of the templet shall be at right angles to the edges; and

c) openings having other than a circular cross section or parallel edges, for example, the open ends of a parallel sided trough reflector, the plane of the templet shall be in the most unfavourable position subject to the requirements of **6.6.1** being satisfied.

In this position no part of the emitter shall touch the templet.

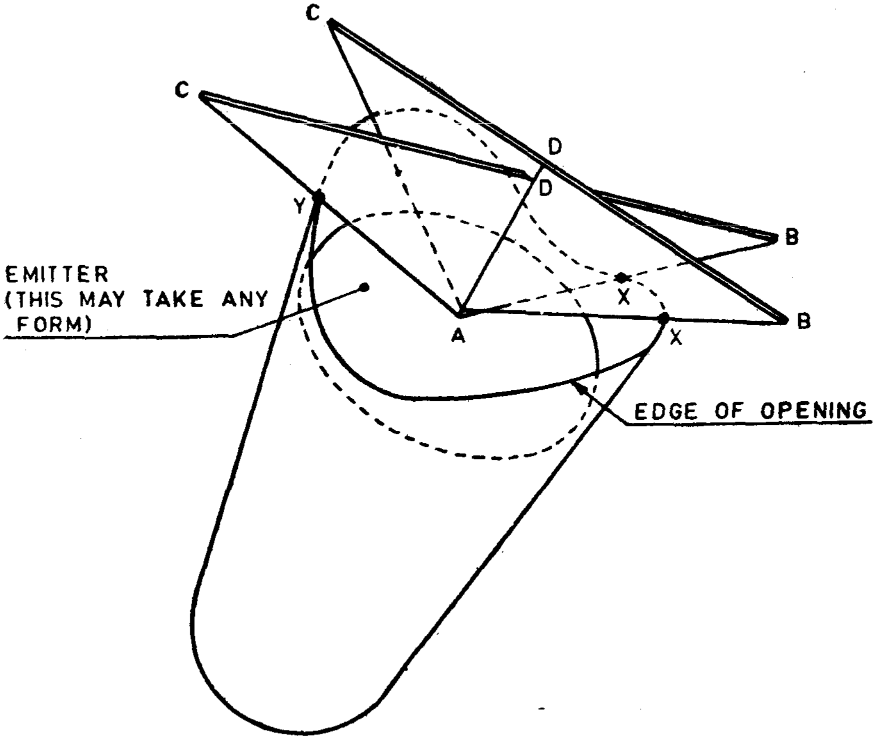
NOTE 1 — Typical examples of testing for recession of emitters are shown in Fig. 3B and 3C.

NOTE 2 — Where on infra-red radiant heater on ultra-violet emitter is situated behind a lens or screen such that it is not accessible to the standard test finger, the lens or screen is not considered to be part of the emitter, and is therefore not required to comply with **3.11.1** and **6.6**. However if the lens or screen does not comply with the requirements of **3.11.1** and **6.6** it is considered that its susceptibility to mechanical damage is increased and the lens or screen must comply with the mechanical strength test of **6.7**.



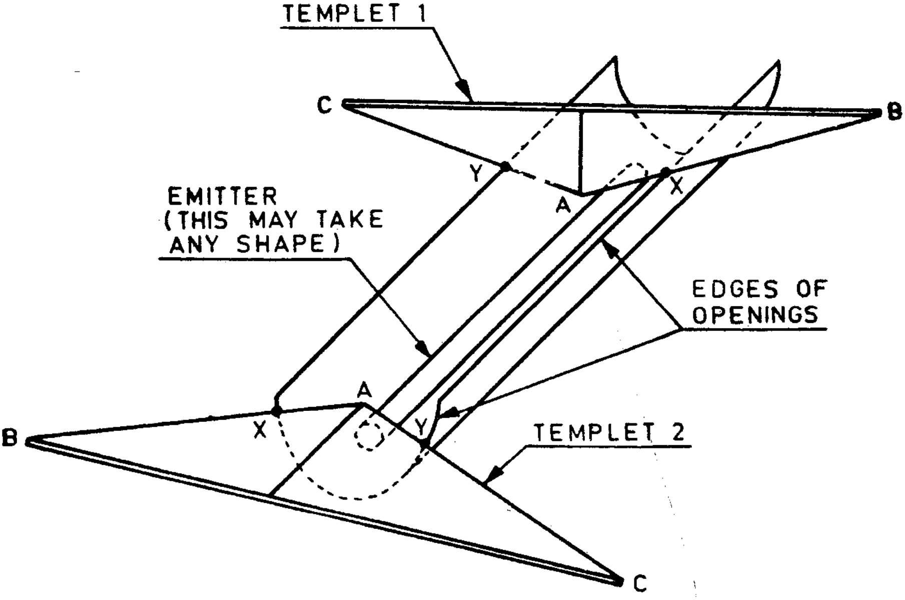
3A Emitter Recession Test Templet — *Contd*

NOTE — The length of the straight line *BDC* should be suitably chosen in relation to the size of the lamp being tested, but the angles *B* and *C* should always remain 25°. *AD* is the axis of the templet and, of course, is at right angles to the line *BDC*.



3B Use of Emitter Recession Test Templet — *Contd*

NOTE — Example of emitter recession test templet being used to test a lamp having a circular cross-section opening X and Y are the points of contact of the templet with the edge of the opening, and the lengths AX and AY are made equal and the line joining X and Y is a diameter of the circular cross section.



3C Use of Emitter Recession Test Templet

NOTE — Example of emitter recession test templet being used to test a lamp having an opening with parallel edges and end openings neither circular in cross section nor with parallel edges. *X* and *Y* are the points of contact of the templet with edges of the openings, and the lengths *AX* and *AY* are made equal. In addition, templet 1 should be at right angles to the parallel edges and templet 2 must be in the most unfavourable position.

FIG. 3 EMITTERS RECESSION TEST OF TEMPLET USE

6.7 Mechanical Strength — This test shall be conducted on infra-red and radiant-heat emitters only. Infra-red and radiant heat emitter shall be subjected to three blows using an impact test apparatus similar to that shown in Fig. 4 (*see also* **21.1** of IS : 302-1979*).

The striking element of the impact test apparatus shall have a hemispherical face of radius 10 mm and shall be made of hardwood, polyamide or similar material and weighing 0·15 kg. It shall be rigidly fixed to the lower end of a steel tube with an external diameter of 9 mm and thickness of 0·5 mm, which shall be pivoted at its upper end in such a way that it shall swing only in the vertical plane of the axis of the striking element. The axis of the pivot shall be 1 metre above the axis

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*General and safety requirements for household and similar electrical appliances (*fifth revision*).

of the striking element. The design of the apparatus shall be such that a force between 1·0 and 2·0 N shall be applied to the face of the hammer to maintain the pendulum in a horizontal position. The lamp shall be held against a solid wall of brick, concrete or the like, and the test apparatus shall be so arranged that the pivot of the pendulum is vertically above the point of impact of the hammer on the emitter. The hammer shall be allowed to fall from a height of 250 mm.

At the conclusion of this test, live parts shall not have become exposed and the lamp shall still comply with the requirements of **3.13**.

The failure of an emitter to operate following this test shall not constitute non-compliance with this specification.

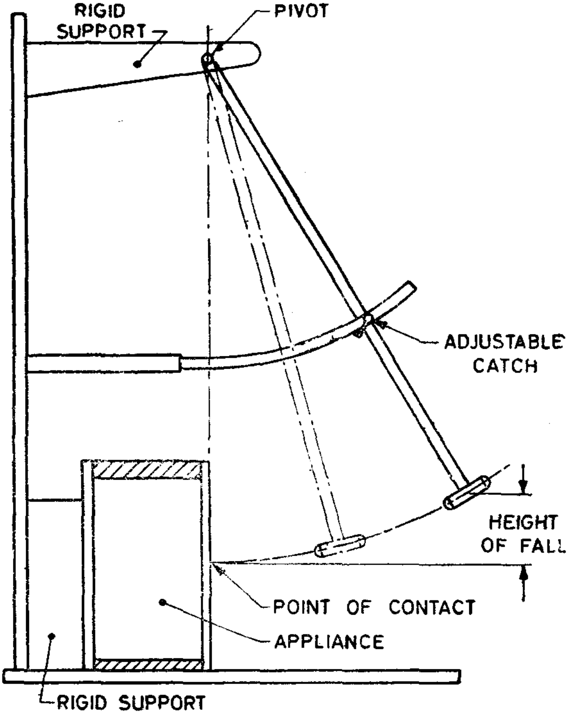


FIG. 4 APPARATUS FOR IMPACT TEST

6.8 Test for Flammability for Effectiveness of Guard (if Fitted) — The lamp shall be operated for 30 minutes at its rated voltage or where a voltage range is marked, at the higher of the voltages, at the end of which time a piece of dry flannelette 100 mm wide and sufficiently long to pass over the front of the lamp and placed in the most unfavourable position thermally, shall not smoulder or ignite within 10-seconds.

6.9 Cord Anchorage Test (Non-detachable Flexible Cords Only) — Where a lamp is fitted with a non-detachable flexible cord it shall not be possible to push the cord further into the lamp. The flexible cord shall be subjected 10 times for 1 second to a pull of 0·7 N. The pull shall not be applied in jerks. Immediately afterwards, the cord shall be subjected for a period of 1 minute to a torque of 0·35 N.m. The test shall be made with the flexible cord as supplied with the appliance.

During the test, damage shall not be caused to the flexible cord. At the end of the test, the end shall not have been displaced by more than 2 mm and the ends of the conductors shall not have been noticeably displaced in the terminals.

6.10 Insulation Resistance and Electric Strength Tests

6.10.1 *Insulation Resistance* — The insulation resistance shall be measured with approximately 500 volts dc the test voltage being obtained from an independent source or generated in the measuring instrument. The test shall be made:

a) between live parts and the following parts connected together: accessible metal parts, metal foil on external parts of insulating material, shafts of handles, knobs, grips and the like, if of metal and if these handles, etc, can be removed without tools;

b) between live parts of different polarity as far as the necessary disconnections can be made without damaging the appliance; and

c) between metal enclosures or metal covers lined with insulating material and metal foil on the inner surface of the lining if the clearance between live parts and these metal enclosures or covers, without the lining, is less than required in **3.9**.

Any flexible cord and any associated connector or plug supplied with the lamp shall be tested with the lamp.

The insulation resistance shall be not less than the following values:

For basic insulation of a lamp employing emitters which are detachable or can be switched off separately:

a) each emitter	2 MΩ
b) complete lamps after removal of emitters	2 MΩ

c) other lamps from which the emitters cannot be removed	2 MΩ
For protective and reinforced insulation, including insulation with metal foil on the outer surface	7 MΩ

6.10.2 *Electric Strength Test* — The insulation shall be subjected for 1 minute to an ac voltage of substantially sinewave form having a frequency of 50 or 60 Hz.

The test voltage shall be applied between the parts indicated in Table 3 the value of the voltage being as indicated in that table. Emitters fitted with bayonet or Edison screw caps and pilot lamps connected across main supply leads shall be removed or disconnected during this test.

Initially, not more than half the prescribed voltage shall be applied following which it shall be raised rapidly to the prescribed value. Care shall be taken when applying the metal foil to a class I lamp to ensure that adequate clearance is maintained between the foil and external metal parts, in order to avoid over-stressing the insulation between live parts and earthed metal parts.

Breakdown or flashover shall not occur during this test.

6.11 Electrical Insulation and Leakage Current at Operating Temperature — Electrical insulation shall be checked by the measurement of leakage current when the lamp is operated at its rated voltage or, if a voltage range is marked, at the higher of the voltages.

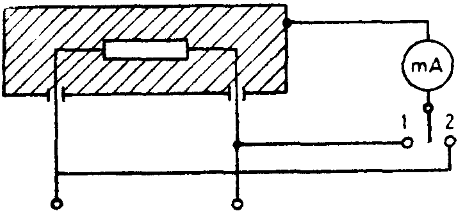
The leakage current which may flow from any pole of the supply main to accessible metal parts and metal foil wrapped closely around external parts of insulating material connected together, and for a class IIB lamp, to any metal which is separated from live parts by basic insulation only, shall be measured. For class I or IIA lamps the circuit of Fig. 5A is used, and for class IIB lamps the circuit of Fig. 5B.. The resistance of the measuring circuit shall be 2 000 ± 100 Ω. The leakage current, both for position *A* and *B* of the changeover switch shall not exceed the following values:

a) To external metal parts, etc, of a class I lamp (Fig. 5A):	
for a portable lamp	300 μA peak
for transportable and stationary lamps	300 μA peak
b) To basic insulation parts of a class IIB lamp (Fig. 5B with changeover switch in position B)	300 μA peak

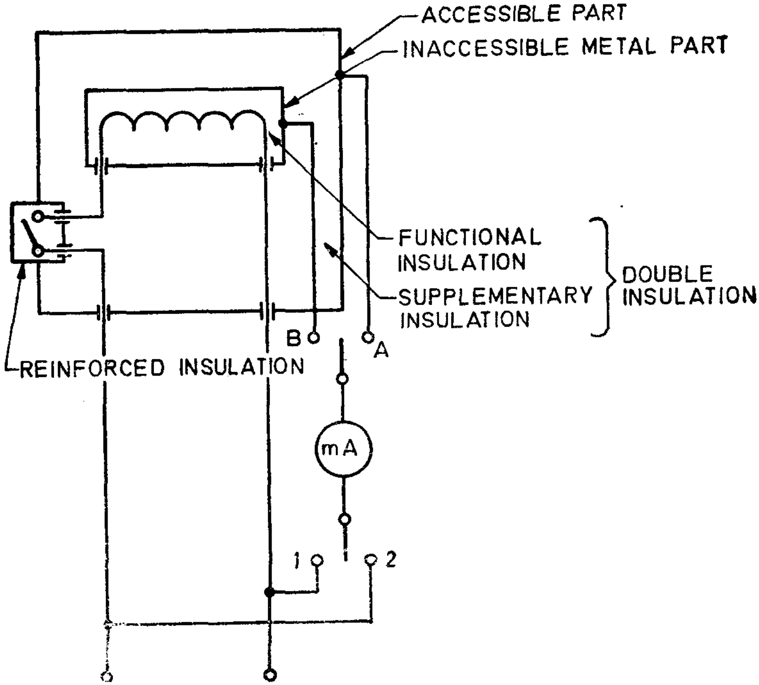
c) To exposed metal parts of a class IIB lamp (Fig. 5B, with changeover switch in position A) 60 μA peak

d) Metal foil on the outer surface of a class IIA lamp (Fig. 5A) 60 μA peak

The test shall be made with ac except in the case of a lamp for dc only, when dc shall be used and the lamp shall be insulated from earth or, in the case of an ac lamp, supplied through an isolating transformer.



5A Diagram for Leakage Current Measurement at Operating Temperature for Class I and II Appliances



5B Diagram for Leakage Current Measurement at Operating Temperature for Class IIB Appliances

FIG. 5 CIRCUIT DIAGRAMS FOR LEAKAGE CURRENT MEASUREMENTS

TABLE 3 TEST VOLTAGE

(*Clause* 6.10.2)

SL No.	POINT OF APPLICATION OF TEST VOLTAGE	TEST VOLTAGE V
1.	Class I lamps:	
	a) Between live parts of opposite polarity; between live parts and accessible or inaccessible metal parts	1 000
	b) Between live parts and metal foil on external parts of insulating material (including switch knobs) unless there is an intermediate metal part which is earthed	3 500
	c) Across live parts of micro-gap switches in the open position	750
	d) Across insulation on the shafts of handles	2 500
2.	Class II lamps:	
	a) Across basic insulation: between live parts of opposite polarity; between live parts and inaccessible metal parts across basic insulation of internal wiring	1 000
	b) Across insulation on the shafts of handles	2 500
	c) Across protecting insulation between inaccessible and accessible parts; across the insulation of sleeves or the like used as protecting insulation on internal wiring	2 500
	d) Across the insulation of cord inlet bushings, including cord guard and cord grip, that is, between accessible metal parts and a metal rod inserted instead of the cord, the metal rod having the same diameter as the cord	2 500
	e) Across reinforced insulation between live parts and accessible metal parts and metal foil on external parts of insulating material	4 000
	f) Across live parts of micro-gap switches in the open poistion	750

NOTE 1 — Where a class I lamp incorporates parts with double or reinforced insulation the values given in item 2 apply to those parts. The test between live parts of opposite polarity of class I and class II lamps shall be applied only in the case of lamps with switches or similar controls in the open position. Where the contact gap of the switch or control is such that it will not stand the application of this test voltage (for example, micro-gap switches) it should be suitably protected before the voltage test is made.

NOTE 2 — Capacitors between live parts of opposite polarity shall not be subjected to this test.

6.12 Earth Continuity (Class I Only) — A current of 1·5 times rated current or 25 A ac whichever is greater shall be passed between the earth terminal and every non-current carrying metal part which may become live in the event of the insulation fault and which can be touched with the standard test finger. The potential between the earth conductor at the free end of the flexible cord and the point of the contact of the test probe shall be measured and the resistance calculated. In no case shall the resistance exceed 0·1 Ω.

The current shall be derived from a source, the voltage of which does not exceed 12 V. The resistance of the earthing conductor of the flexible cord is not included in the resistance measurement.

6.13 Test for Spectral Characteristics — Spectral and energy characteristics of the lamp shall be tested to verify the declared specification of the manufacturer.

6.14 Test for Uniformity of Heating — When the lamps are operated at the rated voltage, excessive hot spots shall not be observed in the emitter part.

6.15 Life Test — (*under consideration*).